CLAIMS

1. (Unchanged) An apparatus for rotating a display orientation of captured image data representative of an object, the apparatus comprising:

    an image sensor, for generating said captured image data;

    an orientation sensor coupled to said image sensor, for generating a signal corresponding to the position of the image sensor relative to said object;

    a memory, having an auto-rotate unit comprising program instructions for selectively transforming said captured image data into rotated image data in response to said position signal, said memory coupled to said image sensor and to said orientation sensor; and

    an image processing unit coupled to said memory for executing program instructions stored in said memory; and

    an image capture unit generates an additional row and column of pixels for said captured image data from said image sensor

[wherein (a) said image processing unit processes an i-by-j array of said captured image data and said image sensor generates an i+1-by-j+1 array of said image data, or (b) an image capture unit generates an additional row and column of pixels for said captured image data from said image sensor].

2. (As Filed) The apparatus of claim 1, wherein the memory further comprises:

    an image processing unit comprising program instructions for transforming one from a group consisting of captured image data and portrait image data, into processed image data.

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3. (As Filed) The apparatus of claim 1, wherein: the signal is a portrait_left

signal if the image sensor is rotated clockwise from a landscape orientation relative

to the object, and the signal is a portrait_right signal if the image sensor is rotated

counter-clockwise from the landscape orientation relative to the object; and

    the auto-rotate unit comprises program instructions for transforming the

        captured image data into portrait_left image data in response to the

        portrait_left signal and into portrait_right image data in response to

        the portrait_right signal.

4. (As Filed) The apparatus of claim 1, wherein:

    the signal is a landscape signal if the image sensor is positioned in a level

        orientation relative to the object; and

    the auto-rotate unit comprises program instructions for transforming the

        captured image data into landscape image data in response to the

        landscape signal.

5. (As Filed) The apparatus of claim 3, wherein:

    the image sensor has a top, a bottom, a right side and a left side;

    the auto-rotate unit program instructions transform the captured image

        data into the portrait_left image data by transferring a prior por-

        trait_left line of image data which starts further toward the bottom

        of the image sensor and ends further toward the top of the image

        sensor, then transferring a subsequent portrait_left line of image

        data, located closer to the right side of the image sensor than the

        prior portrait_left line of image data, and also starting further to-

        ward the bottom of the image sensor and ending further toward the

        top of the image sensor; and

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12   the auto-rotate unit program instructions transform the captured image

13   data into the portrait_right image data by transferring a prior por-

14   trait_right line of image data which starts further toward the top of

15   the image sensor and ends further toward the bottom of the image

16   sensor, then transferring a subsequent portrait_right line of image

17   data, located closer to the left side of the image sensor than the prior

18   portrait_right line of image data, and also starting further toward

19   the top of the image sensor and ending further toward the bottom of

20   the image sensor.

1   6. (As Filed) The apparatus of claim 4, wherein:

2   the image sensor has a top, a bottom, a right side and a left side; and

3   the auto-rotate unit program instructions transform the captured image

4   data into the landscape image data by transferring a prior landscape

5   line of image data which starts further toward the left side of the

6   image sensor and ends further toward the right side of the image

7   sensor, then transferring a subsequent landscape line of image data,

8   located closer to the bottom of the image sensor than the prior land-

9   scape line of image data, and also starting further toward the left

10   side of the image sensor and ending further toward the right side of

11   the image sensor.

1   7. (As Filed) The apparatus of claim 3, wherein:

2   the portrait_left signal is generated by the orientation sensor if the image

3   sensor is rotated approximately 45° clockwise from the level orienta-

4   tion, and the portrait_right signal is generated by the orientation

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5   sensor if the imaging subsystem is rotated approximately 45°

6   counter-clockwise from the level orientation.

1   8. (As Filed) The apparatus of claim 5, wherein:

2   the prior portrait_left line of image data and the prior portrait_right line of

3   image data comprise a "green, red, green, red" pixel pattern; and

4   the subsequent portrait_left line of image data and the subsequent por-

5   trait_right line of image data comprise a "blue, green, blue, green"

6   pixel pattern.

1   9. (As Filed) An apparatus for rotating a display orientation of multicolor

2   captured image data having an i-by-j pixel matrix with a pattern representative of an

3   object, comprising:

4   an image sensor, for generating the multicolor captured image data;

5   an input device, for generating a portrait_left signal in response to a first

6   user selection, a portrait_right signal in response to a second user

7   selection, and a landscape signal in response to a third user selec-

8   tion;

9   a memory, having:

10   an auto-rotate unit comprising program instructions for selec-

11   tively transforming the multicolor captured image data

12   into portrait_left image data in response to the portrait-

13   left signal, portrait_right image data in response to the

14   portrait_right signal, and landscape image data in re-

15   sponse to the landscape signal; and

16   an image processing unit comprising program instructions for

17   transforming the portrait_left image data, the por-

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18 trait_right image data and the landscape image data into

19 processed image data; and

20 a processing unit, coupled to the image sensor, to the input device, and to

21 the memory, for executing program instructions stored in the mem-

22 ory;

23 wherein said image processing unit changes the number of pixel rows and

24 pixel columns of the multicolor captured image data such that, from

25 a defined referenced viewpoint, the portrait left image data, the por-

26 trait right image data, and the landscape image data, each includes

27 an (i-1)-by-(j-1) pixel matrix having said pattern.

1 10. (As Filed) The apparatus of claim 9, wherein the image processing unit

2 has a first line length for processing the portrait_left image data and the por-

3 trait_right image data and a second line length for processing the landscape image

4 data.

1 11. (Unchanged) A method for rotating a display orientation of image data

2 representative of an object, comprising the steps of:

3 generating image data with an image sensor;

4 identifying an orientation of the image sensor relative to the object at a

5 time substantially simultaneous with the generating step, where

6 said identifying is performed by an orientation sensor; and

7 selectively transferring data to an image processing unit in response to the

8 identifying step;

9 [wherein said image processing unit rotates said display orientation of said image

10 data and (a) said image processing unit processes an i-by-j array of said

11 captured image data and said image sensor generates an i+1-by-j+1 array

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of said image data, or (b) an image capture unit generates an additional row and column of pixels for said captured image data from said image sensor] 173

⌐ wherein said image processing unit rotates said orientation of said image data by generating an additional row and column of pixels for said captured image data from said image sensor.

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12. (Cancelled) [The method of claim 11, further comprising the step of: generating an additional row and column of image data.] 173

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13. (As Filed) The method of claim 11, further comprising the step of correcting defects within the image data caused by defects within the image sensor.

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14. (As Filed) The method of claim 11, wherein the image sensor comprises a top, a right side and a left side, wherein the image comprises a "top portion," and wherein the step of identifying an orientation further comprises the steps of:

identifying a portrait_left orientation, if the left side of the image sensor corresponds to the "top portion" of the object;

identifying a portrait_right orientation, if the right side of the image sensor corresponds to the "top portion" of the object; and

identifying a landscape orientation, if the top of the image sensor corresponds to the "top portion" of the object.

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15. (As Filed) The method of claim 11, wherein the step of identifying an orientation further comprises the steps of:

identifying a portrait_left orientation, in response to a user selection of the portrait_left orientation on an input device;

identifying a portrait_right orientation, in response to a user selection of the portrait_right orientation on the input device; and

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7   identifying a landscape orientation, in response to a user selection of the

8   landscape orientation on the input device.

1   16. (As Filed) The method of claim 11, wherein the orientation is a por-

2   trait_left orientation, wherein the image data is comprised of an array of pixel colors

3   ordered in rows and columns, and wherein the step of selectively transferring com-

4   prises the steps of:

5   initializing a column variable to a first column of pixel colors required by

6   the image processing unit;

7   initializing a row variable to a row containing a first pixel color required

8   by the image processing unit;

9   transferring pixel color at an array location defined by the row variable

10   and the column variable to the image processing unit;

11   decrementing the row variable to a row containing a next pixel color re-

12   quired by the image processing unit;

13   returning to the transferring step, if a row containing a last pixel color has

14   not been transferred;

15   incrementing the column variable to a next column of pixel colors required

16   by the image processing unit; and

17   returning to the initializing a row variable step, if a last column of pixel

18   colors has not been transferred.

1   17. (As Filed) The method of claim 16, wherein the image data is replaced by

2   defective image sensor information, further comprising the step of repeating the

3   steps of claim 16.

1   18. (As Filed) The method of claim 16, further comprises the steps of:

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2   configuring the image processing unit to accept an image data line length

3   corresponding to the portrait_left orientation; and

4   performing image processing on a line of transferred image data.

1   19. (As Filed) The method of claim 11, wherein the orientation is a por-

2   trait_right orientation, wherein the image data is comprised of an array of pixel col-

3   ors ordered in rows and columns, and wherein the step of selectively transferring

4   comprises the steps of:

5   initializing a column variable to a first column of pixel colors required by

6   the image processing unit;

7   initializing a row variable to a row containing a first pixel color required

8   by the image processing unit;

9   transferring pixel color at an array location defined by the row variable

10   and the column variable, to the image processing unit;

11   incrementing the row variable to a row containing a next pixel color re-

12   quired by the image processing unit;

13   returning to the transferring step, if a row containing a last pixel color has

14   not been transferred;

15   decrementing the column variable to a next column of pixel colors re-

16   quired by the image processing unit; and

17   returning to the initializing a row variable step, if a last column of pixel

18   colors has not been transferred.

1   20. (As Filed) The method of claim 11, wherein the orientation is a landscape

2   orientation, wherein the image data is comprised of an array of pixel colors ordered

3   in rows and columns, and wherein the step of selectively transferring comprises the

4   steps of:

5   initializing a row variable to a first row of pixel colors required by the im-

6   age processing unit;

7   initializing a column variable to a column containing a first pixel color re-

8   quired by the image processing unit;

9   transferring pixel color at an array location defined by the row variable

10   and the column variable, to the image processing unit;

11   incrementing the column variable to a column containing a next pixel color

12   required by the image processing unit;

13   returning to the transferring step, if a column containing a last color pixel

14   has not been transferred;

15   incrementing the row variable to a next row of pixel colors required by the

16   image processing unit; and

17   returning to the initializing a column variable step, if a last row of pixel

18   colors has not been transferred.

1   21. (Amended) An apparatus for rotating a display orientation of multicolor

2   image data having an i-by-j pixel matrix with a pattern representative of an object,

3   comprising:

4   means for generating multicolor image data with an image sensor, the im-
                                                                              r
5       $\mathcal{I}$ age data having a Bayer pattern;

6   orientation sensor means for identifying an orientation of said image sen-

7   sor relative to said object at a time substantially simultaneous with

8   said generating said multicolor image data; and

9   means for selectively transferring said multicolor image data to an image

10   processing unit in response to said means for identifying;

11   wherein said image processing unit rotates said display orientation of said

12   multicolor image data for providing rotated multicolor image data,

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and changes the number of pixel rows and pixel columns of said
multicolor image data such that, from a defined referenced view-
point, said rotated multicolor image data includes an (i-1)-by-(j-1)
pixel matrix having said pattern.

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22. (As Filed) The apparatus of claim 21, further comprising means for gener-
ating an additional row and column of image data.

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23. (As Filed) The apparatus of claim 21, further comprising means for cor-
recting defects within the image data caused by defects within the image sensor.

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24. (As Filed) The apparatus of claim 21, wherein the image sensor comprises
a top, a right side and a left side, wherein the image comprises a "top portion," and
wherein the means for identifying an orientation further comprises:
        means for identifying a portrait_left orientation, if the left side of the image
                sensor corresponds to the "top portion" of the object;
        means for identifying a portrait_right orientation, if the right side of the
                image sensor corresponds to the "top portion" of the object; and
        means for identifying a landscape orientation, if the top of the image sen-
                sor corresponds to the "top portion" of the object.

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25. (As Filed) The apparatus of claim 21, wherein the orientation is a por-
trait_left orientation, wherein the image data is comprised of an array of pixel colors
ordered in rows and columns, and wherein the means for selectively transferring
comprises:
        means for initializing a column variable to a first column of pixel colors re-
                quired by the image processing unit;

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7   means for initializing a row variable to a row containing a first pixel color

8   required by the image processing unit;

9   means for transferring pixel color at an array location, defined by the row

10   variable and the column variable, to the image processing unit;

11   means for decrementing the row variable to a row containing a next pixel

12   color required by the image processing unit;

13   means for returning to the means for transferring, if a row containing a last

14   pixel color has not been transferred;

15   means for incrementing the column variable to a next column of pixel col-

16   ors required by the image processing unit; and

17   means for returning to the means for initializing a row variable, if a last

18   column of pixel colors has not been transferred.

1   26. (As Filed) The apparatus of claim 21, wherein the orientation is a por-

2   trait_right orientation, wherein the image data is comprised of an array of pixel col-

3   ors ordered in rows and columns, and wherein the means for selectively transferring

4   comprises:

5   means for initializing a column variable to a first column of pixel colors re-

6   quired by the image processing unit;

7   means for initializing a row variable to a row containing a first pixel color

8   required by the image processing unit;

9   means for transferring pixel color at an array location, defined by the row

10   variable and the column variable, to the image processing unit;

11   means for incrementing the row variable to a row containing a next pixel

12   color required by the image processing unit;

13   means for returning to the means for transferring, if a row containing a last

14   pixel color has not been transferred;

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15 means for decrementing the column variable to a next column of pixel col-

16 ors required by the image processing unit; and

17 means for returning to the means for initializing a row variable, if a last

18 column of pixel colors has not been transferred.

1   27. (As Filed) The apparatus of claim 21, wherein the orientation is a land-

2   scape orientation, wherein the image data is comprised of an array of pixel colors or-

3   dered in rows and columns, and wherein the means for selectively transferring com-

4   prises:

5   means for initializing a row variable to a first row of pixel colors required

6   by the image processing unit;

7   means for initializing a column variable to a column containing a first pixel

8   color required by the image processing unit;

9   means for transferring pixel color at an array location, defined by the row

10 variable and the column variable, to the image processing unit;

11 means for incrementing the column variable to a column containing a next

12 pixel color required by the image processing unit;

13 means for returning to the means for transferring, if a column containing a

14 last color pixel has not been transferred;

15 means for incrementing the row variable to a next row of pixel colors re-

16 quired by the image processing unit; and

17 means for returning to the means for initializing a column variable, if a last

18 row of pixel colors has not been transferred.

1   28. (Amended) A computer useable medium embodying computer readable

2   program code for causing a computer to rotate a display orientation of multicolor

3   image data having an i-by-j pixel matrix with a pattern representative of an object, by

4   performing steps comprising:

5   generating said multicolor image data with an image sensor, the image

6   data having a Bayer pattern;

7   identifying an orientation of the image sensor relative to the object at a

8   time substantially simultaneous with the generating step, wherein

9   said identifying of said orientation is performed with an orientation

10   sensor; and

11 selectively transferring image data to an image processing unit in response

12   to the identifying step,

13 wherein said image processing unit rotates said display orientation of said

14   multicolor image data for providing rotated multicolor image data,

15   and changes the number of pixel rows and pixel columns of said

16   multicolor image data such that, from a defined referenced view-

17   point, said rotated multicolor image data includes an (i-1)-by-(j-1)

18   pixel matrix having said pattern.

1   29. (As Filed) The computer useable medium of claim 28, further comprising

2   program code for generating an additional row and column of image data.

1   30. (As Filed) The computer useable medium of claim 28, further comprising

2   program code for correcting defects within the image data caused by defects within

3   the image sensor.

1   31. (As Filed) The computer useable medium of claim 28, wherein the image

2   sensor comprises a top, a right side and a left side, wherein the image comprises a

3   "top portion," and wherein the program code for performing the step of identifying

4   an orientation further comprises program code for:

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5   identifying a portrait_left orientation, if the left side of the image sensor

6   corresponds to the "top portion" of the object;

7   identifying a portrait_right orientation, if the right side of the image sensor

8   corresponds to the "top portion" of the object; and

9   identifying a landscape orientation, if the top of the image sensor corre-

10 sponds to the "top portion" of the object.

1   32. (As Filed) The computer useable medium of claim 28, wherein the orien-

2   tation is a portrait_left orientation, wherein the image data is comprised of an array

3   of pixel colors ordered in rows and columns, and wherein the program code for per-

4   forming the step of selectively transferring comprises program code for:

5   initializing a column variable to a first column of pixel colors required by

6   the image processing unit;

7   initializing a row variable to a row containing a first pixel color required

8   by the image processing unit;

9   transferring pixel color at an array location, defined by the row variable

10 and the column variable, to the image processing unit;

11 decrementing the row variable to a row containing a next pixel color re-

12 quired by the image processing unit;

13 returning to the transferring step, if a row containing a last pixel color has

14 not been transferred;

15 incrementing the column variable to a next column of pixel colors required

16 by the image processing unit; and

17 returning to the initializing a row variable step, if a last column of pixel

18 colors has not been transferred.

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33. (As Filed) The computer useable medium of claim 28, wherein the orientation is a portrait_right orientation, wherein the image data is comprised of an array of pixel colors ordered in rows and columns, and wherein the program code for performing the step of selectively transferring comprises program code for:

initializing a column variable to a first column of pixel colors required by the image processing unit;

initializing a row variable to a row containing a first pixel color required by the image processing unit;

transferring pixel color at an array location, defined by the row variable and the column variable, to the image processing unit;

incrementing the row variable to a row containing a next pixel color required by the image processing unit;

returning to the transferring step, if a row containing a last pixel color has not been transferred;

decrementing the column variable to a next column of pixel colors required by the image processing unit; and

returning to the initializing a row variable step, if a last column of pixel colors has not been transferred.

34. (As Filed) The computer useable medium of claim 28, wherein the orientation is a landscape orientation, wherein the image data is comprised of an array of pixel colors ordered in rows and columns, and wherein the program code for performing the step of selectively transferring comprises program code for:

initializing a row variable to a first row of pixel colors required by the image processing unit;

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7   initializing a column variable to a column containing a first pixel color re-

8   quired by the image processing unit;

9   transferring pixel color at an array location, defined by the row variable

10   and the column variable, to the image processing unit;

11 incrementing the column variable to a column containing a next pixel color

12   required by the image processing unit;

13 returning to the transferring step, if a column containing a last color pixel

14   has not been transferred;

15 incrementing the row variable to a next row of pixel colors required by the

16   image processing unit; and

17 returning to the initializing a column variable step, if a last row of pixel

18   colors has not been transferred.

1   35. (Amended) An apparatus for rotating a display orientation of multicolor

2   captured image data having an i-by-j pixel matrix with a pattern representative of an

3   object, comprising:

4   an image sensor, for generating said multicolor captured image data, the

5   image data having a Bayer pattern;

6   an orientation sensor coupled to said image sensor, for generating a signal

7   corresponding to the position of said image sensor relative to said

8   object; and

9   a hardware device, having an auto-rotate unit comprising circuits for selec-

10   tively transforming said multicolor captured image data into rotated

11   multicolor image data in response to said position signal, said

12   hardware device coupled to said image sensor and to said orienta-

13   tion sensor;

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14   wherein, from a defined referenced viewpoint, said rotated multicolor im-

15   age data includes an (i-1)-by-(j-1) pixel matrix having said pattern.

1   36. (Unchanged) <u>An apparatus for rotating a display orientation of captured</u>

2   <u>image data representative of an object, the apparatus comprising:</u>

3   <u>an image sensor, for generating said captured image data;</u>

4   <u>an input device, for generating an orientation signal in response to a user</u>

5   <u>selection;</u>

6   <u>a memory, having an auto-rotate unit for selectively transforming said cap-</u>

7   <u>tured image data into rotated image data in response to said orien-</u>

8   <u>tation signal from said input device; and</u>

9   <u>an image processing unit coupled to said memory for processing the image</u>

10   <u>data by generating at least one additional row and column of pixels</u>

11   <u>for said captured image data from said image sensor.</u>

1   37. (Twice Amended) <u>A digital image capture device, comprising:</u>

2   <u>an image sensor, for capturing image data;</u>

3   <u>an orientation sensor, for generating an orientation signal indicating</u>

4   <u>whether the image sensor is in a portrait or landscape position; and</u>

5   <u>an auto-rotate unit coupled to the image sensor and the orientation sensor,</u>

6   <u>for automatically rotating a subset of the image data in response to</u>

7   <u>the orientation signal.</u>

1   [38. (Cancelled)

1   39. (Unchanged) <u>The digital image capture device of claim 37, further com-</u>

2   <u>prising:</u>

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3   an image capture unit coupled to the image sensor, for adding m addi-

4   tional rows and n additional columns to an i-by-j array of image

5   data to form an i+m-by-j+n array of image data to be rotated by the

6   auto-rotate unit in response to the orientation signal.

1   39. (Twice Amended) A method of rotating image data in a digital image

2   capture device, comprising:

3   capturing image data from an image sensor:

4   providing an orientation signal indicating whether the image sensor is in a

5   portrait or landscape position: and

6   automatically rotating a subset of the captured image data in response to

7   the orientation signal.

1   41. (Cancelled)

1   40. (Unchanged) The method of claim 39, further comprising:

2   adding m additional rows and n additional columns to an i-by-j array of

3   the image data to form an i+m-by-j+n array of image data.

1   41. (Twice Amended) A computer-readable medium having stored thereon

2   instructions which, when executed by a processor, cause the processor to perform the

3   steps of:

4   capturing image data from an image sensor:

5   providing an orientation signal indicating whether the image sensor is in a

6   portrait or landscape orientation: and

7   automatically rotating a subset of the captured image data in response to

8   the orientation signal.

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1   44. (Cancelled)

1   45. (Unchanged) The computer-readable medium of claim 40, further com-

2   prising:

3   adding m additional rows and n additional columns to an i-by-j array of

4   the image data to form an i+m-by-j+n array of image data.

1   46. (Amended Three Times) A digital image capture device, comprising:

2   image sensor means for generating image data;

3   means for generating an orientation signal indicating either a portrait ori-

4   entation or a landscape orientation of the image sensor; and

5   means for automatically rotating a subset of the image data in response to

6   the orientation signal.

1   47. (Unchanged) A digital image capture device, comprising:

2   an image sensor, for generating said captured image data including a plu-

3   rality of rows and columns of pixels;

4   an orientation sensor coupled to said image sensor, for generating a posi-

5   tion signal indicating whether the image sensor is in a portrait or

6   landscape position;

7   a memory, having an auto-rotate unit comprising program instructions for

8   selectively transforming said captured image data into rotated im-

9   age data in response to said position signal by processing at least

10   one row of pixels and at least one column of pixels less than the plu-

11   rality of rows and columns of pixels in the captured image data,

12   said memory coupled to said image sensor and to said orientation

13   sensor; and

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an image processing unit coupled to said memory for executing the stored

program instructions to rotate said capture image data.

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15. (Unchanged) A method for rotating a display orientation of image data,

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comprising:

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generating image data with an image sensor including a plurality of rows

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and columns of pixels;

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determining with an orientation sensor a portrait orientation or a land-

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scape orientation for the image data substantially simultaneously

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with generating the image data; and

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processing the image data with an image processing unit in response to the

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orientation signal to rotate the image data, by rotating less than all

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of the plurality of rows and columns of pixels of the image data.

END

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